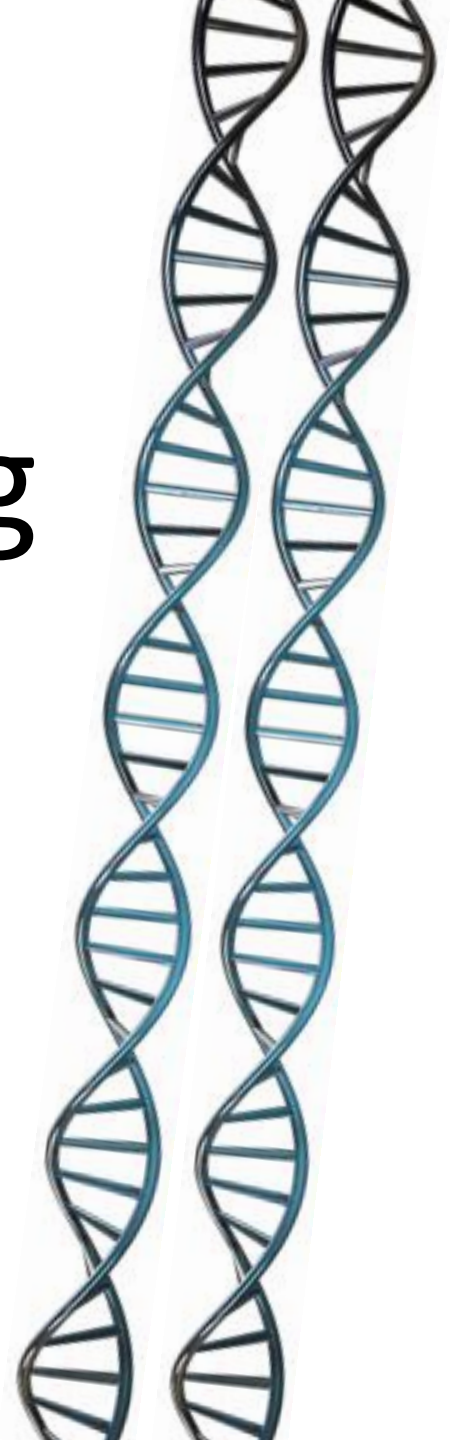


# Genetic Engineering Workshop

*How to manipulate DNA*

5 August 2015



# Outline

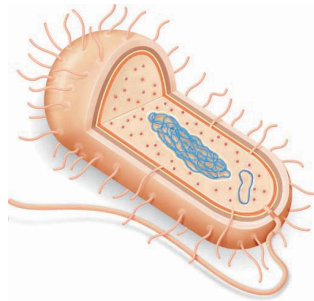
1. Introduction to genetic engineering
2. Basis of genetic engineering
3. Tools of the trade
4. Controls
5. Puzzle exercise

# Introduction

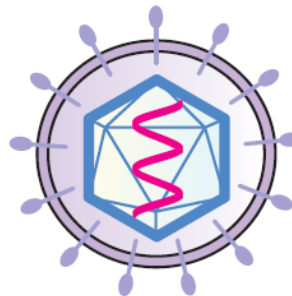
# Genetic Engineering

- Modifying characteristics of an organisms by manipulating its genetic material

Add/change



Bacteria



Virus



Fish



Even cats!



Plants

# Examples



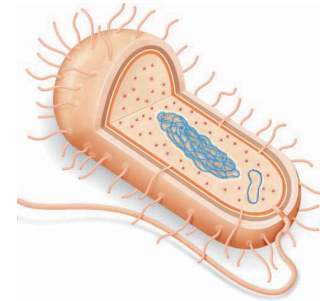
Maize plant



European corn borer



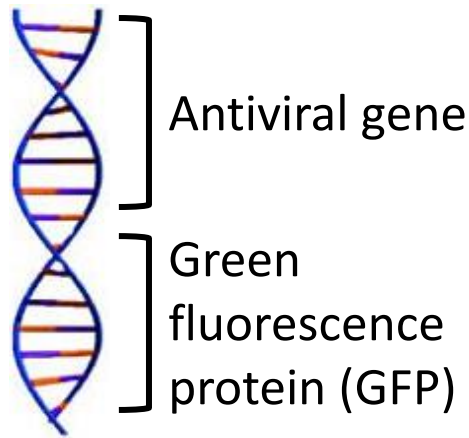
Crystal protein



*Bacillus thuringiensis*

# Examples

- Glow-in-the-dark cats
  - To gain insights into AIDS (caused by HIV)



Inject into  
embryos



~~Has FIV~~

Resistance  
conferred against  
FIV

Fe Virus

Human Immunodeficiency Virus



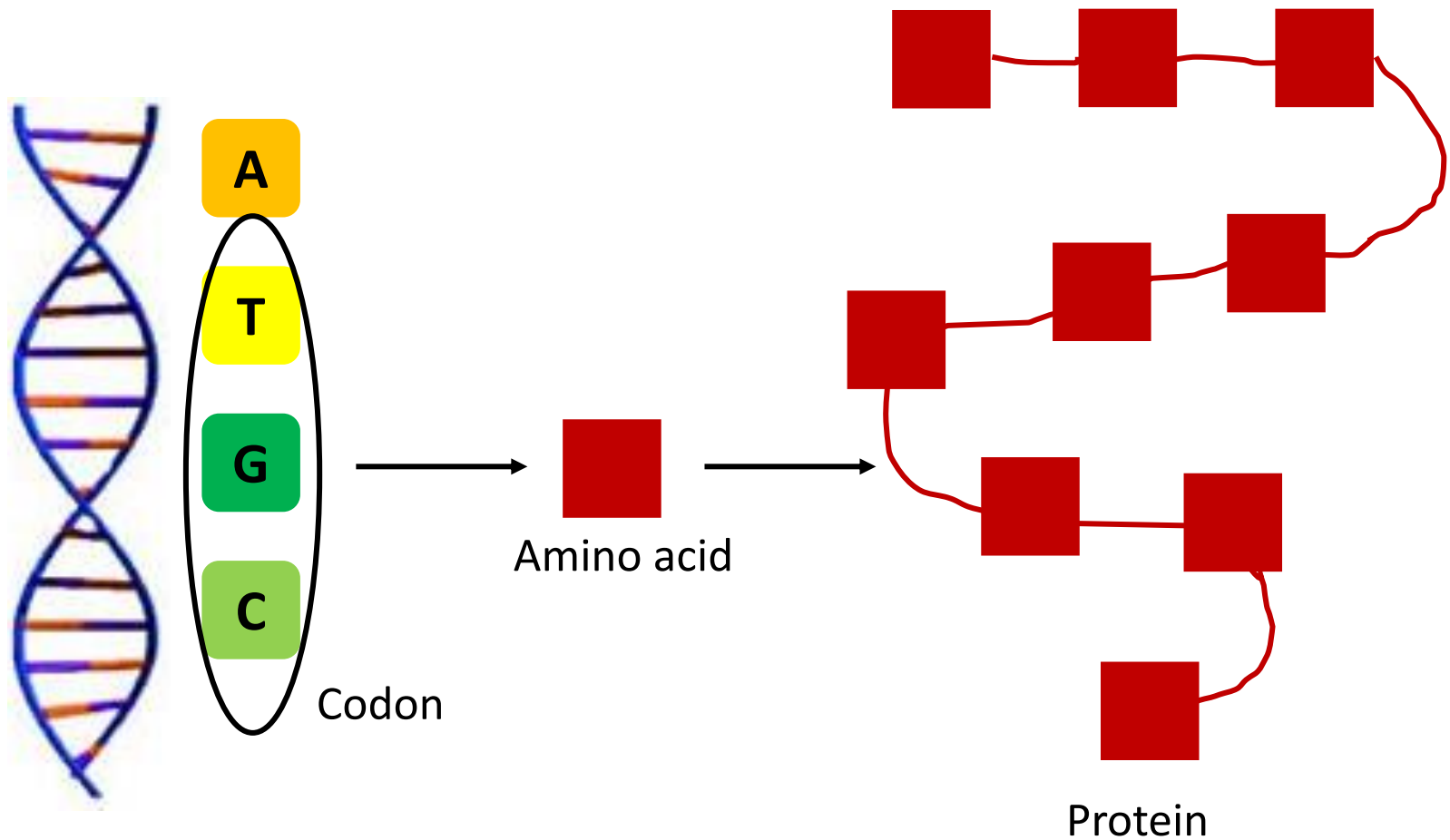


**Meow?!**

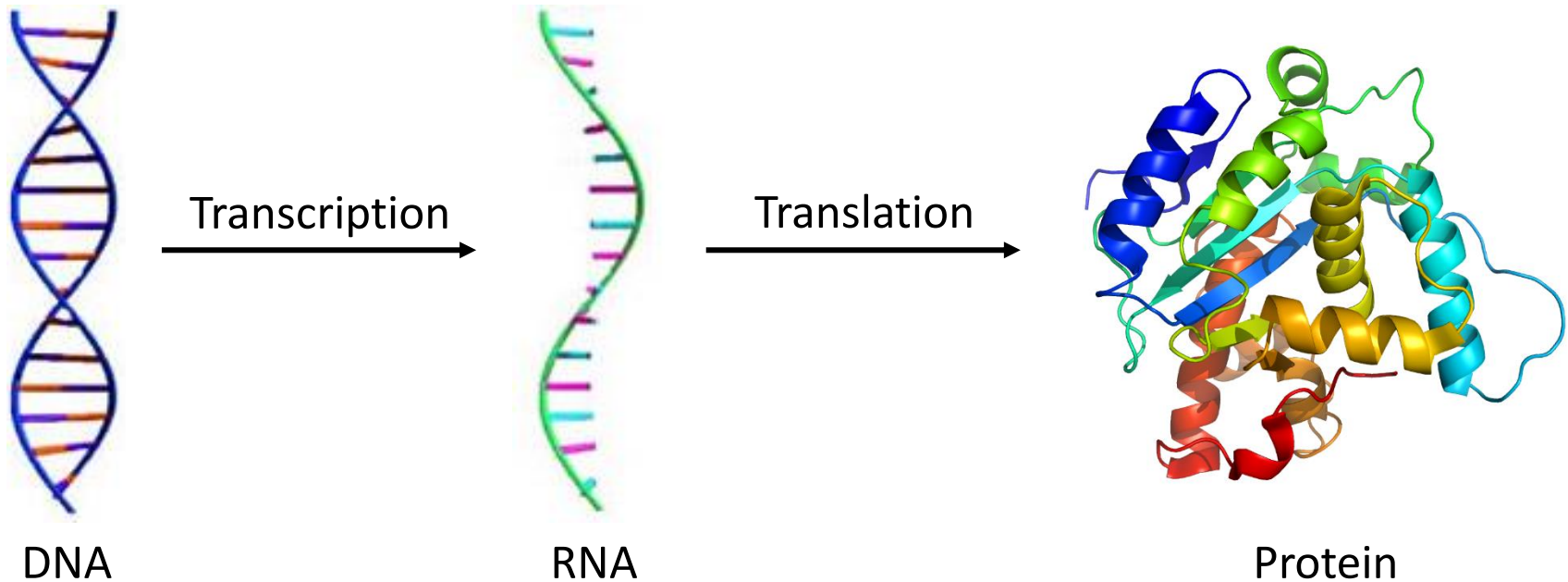
# Basis



# The Genome Has Meaning



# Central Dogma of Genetics

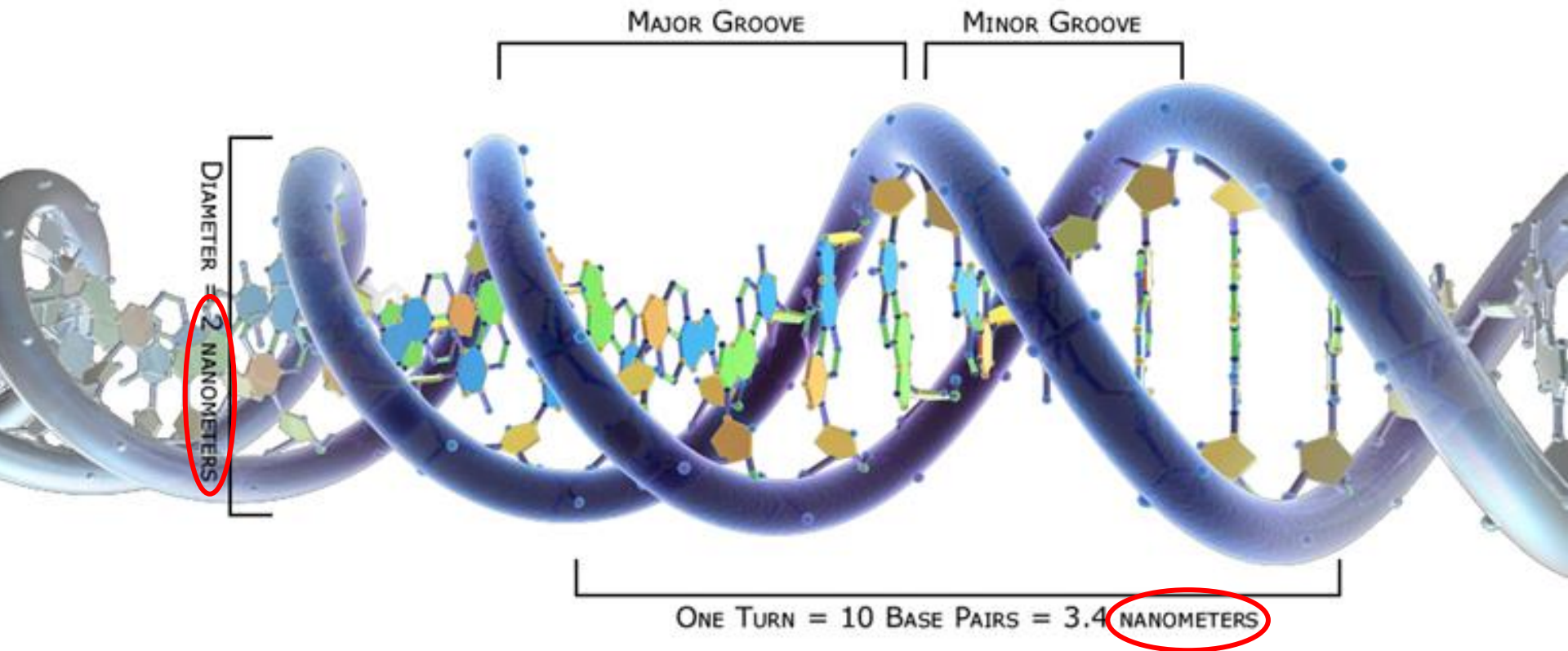


**Applies to all organisms on Earth!**

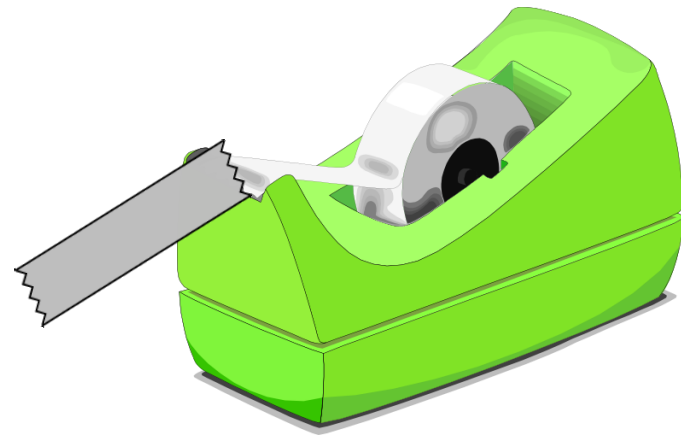
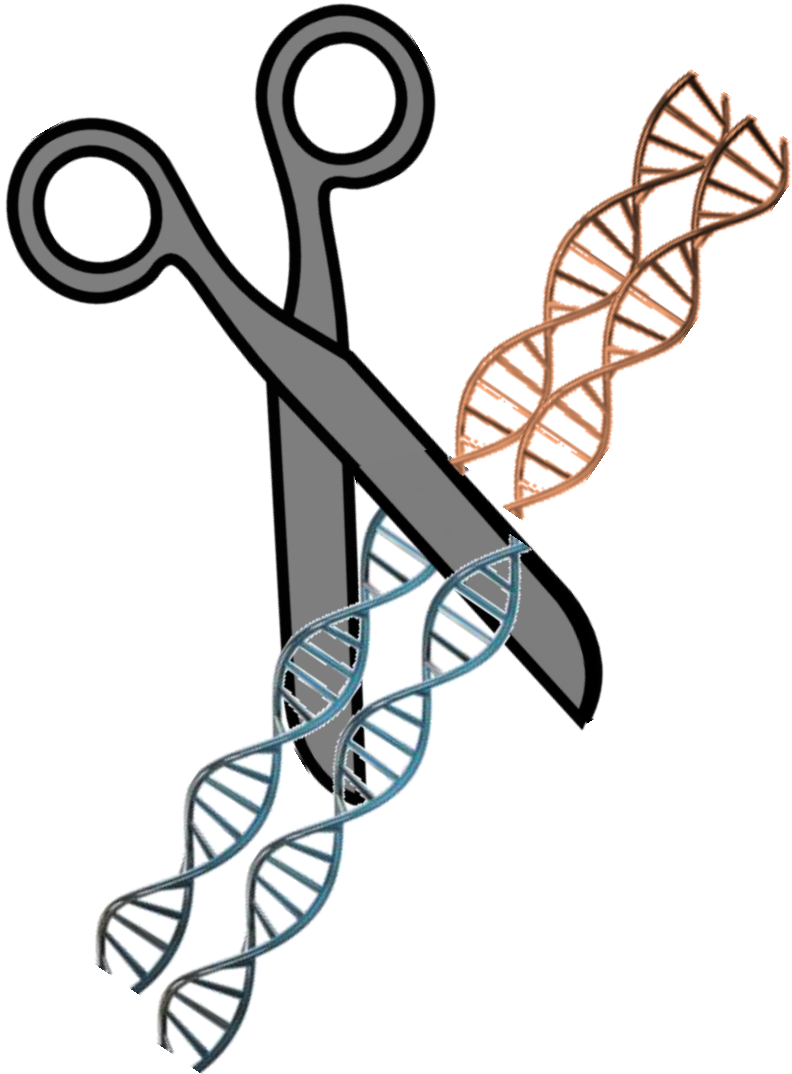


Tools

# DNA is Small



1 Nanometer =  $1 \times 10^{-9}$  = 0.000000001 meters



Introduction

Basis

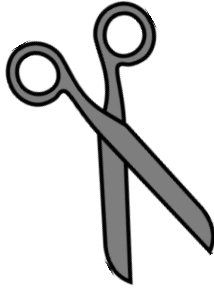
Tools

Controls

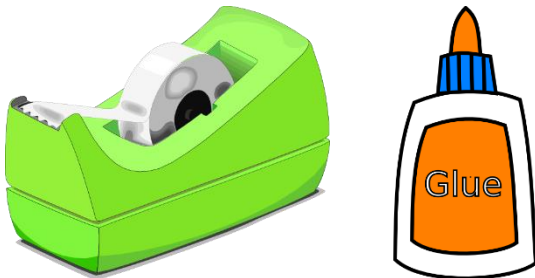
Puzzles

Tools

Cellular parallel



Restriction enzymes



Ligases



Polymerases



# Let's Create our Own...



# Step 1: Decide on the Genes



Antiviral  
gene



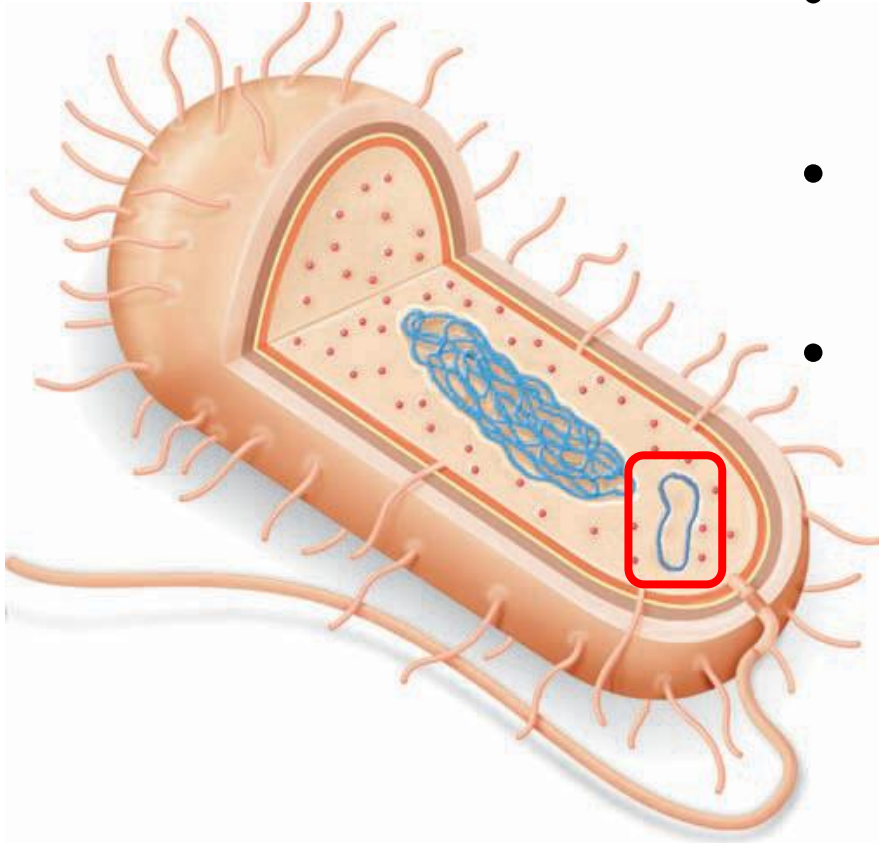
Green  
fluorescence  
protein (GFP)



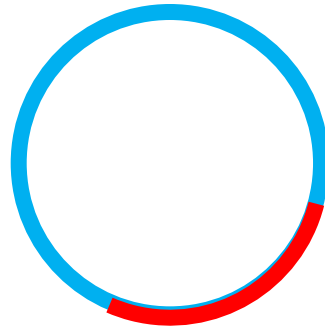
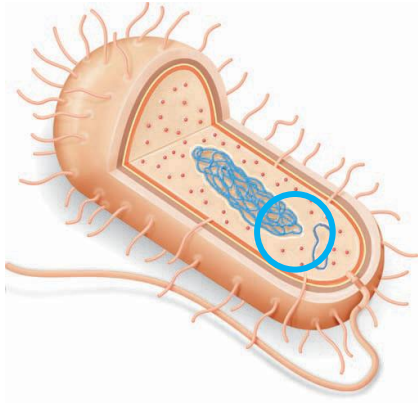
# Step 2: Obtain the Gene

## Plasmid

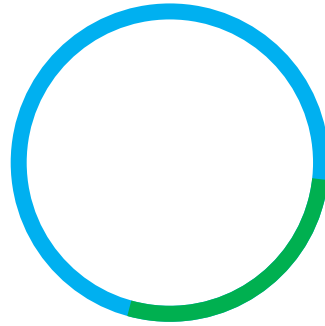
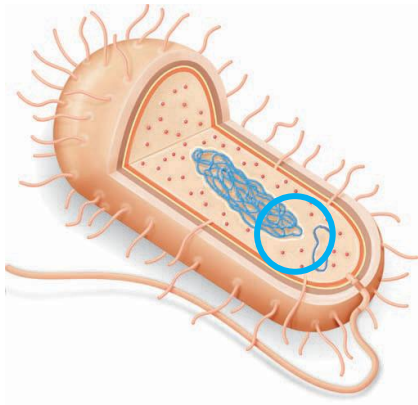
- Small DNA often found in bacteria
- A vector/messenger that carries genes
- Can be placed in other organisms to express proteins



# Step 2: Obtain the Gene

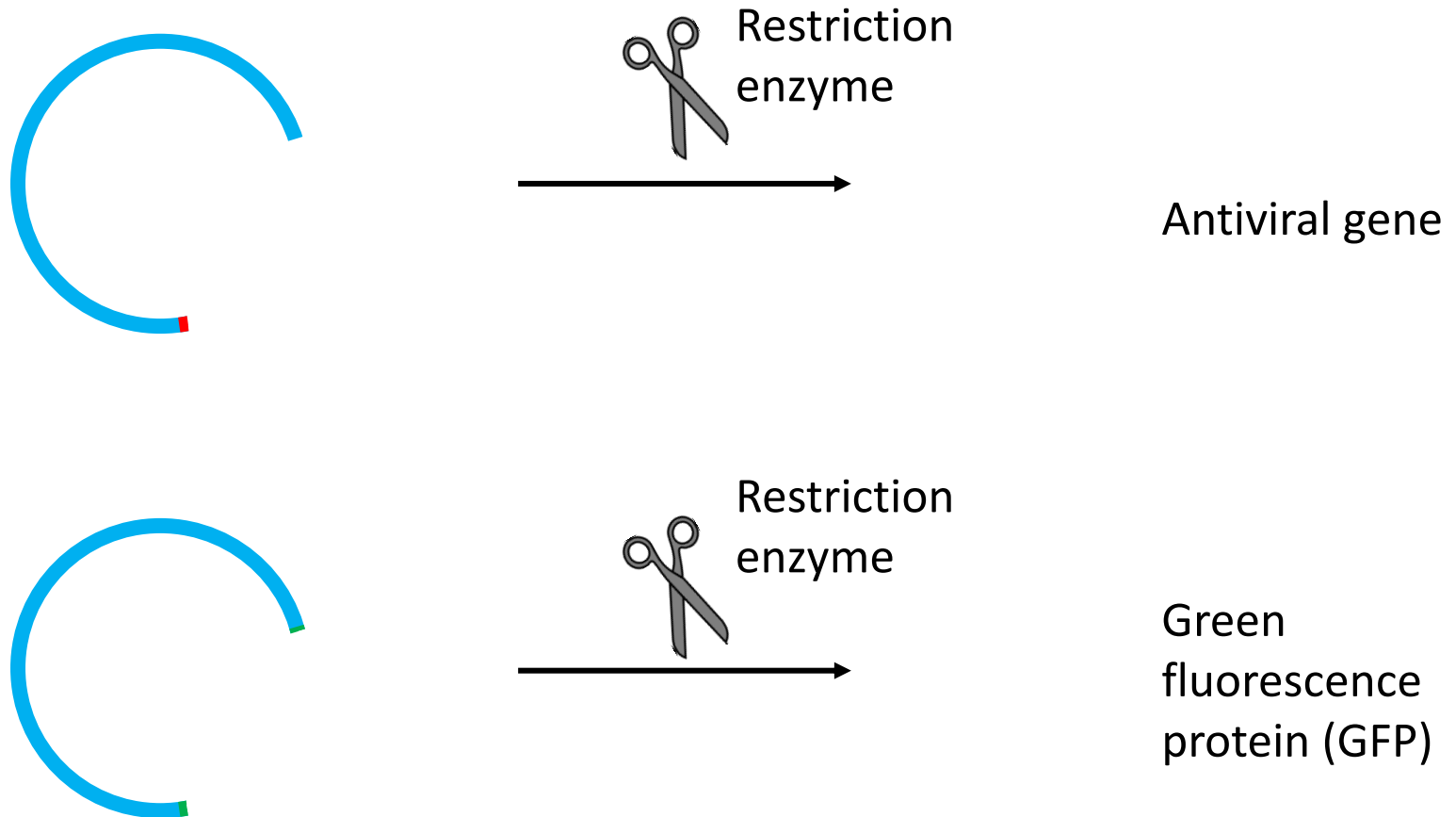


Antiviral gene



Green  
fluorescence  
protein (GFP)

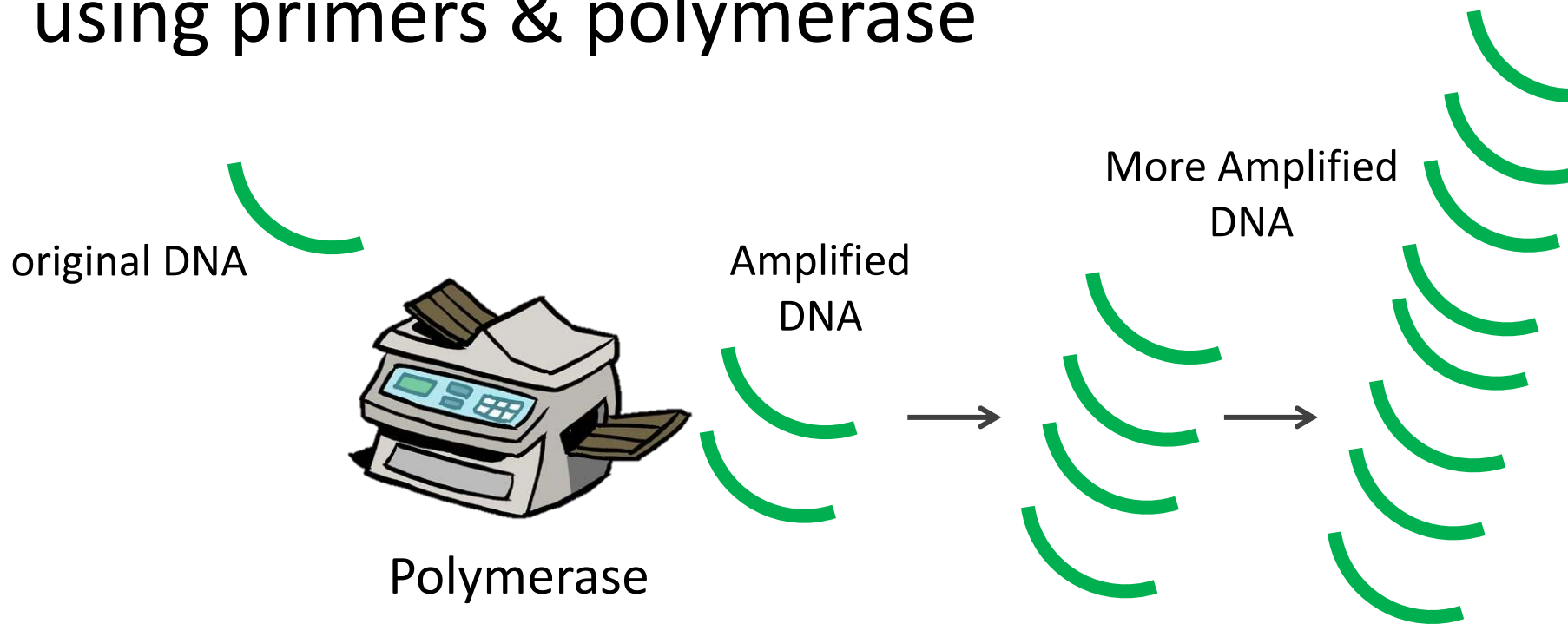
# Step 3: Extraction of the Genes



# Step 4: Make more via PCR

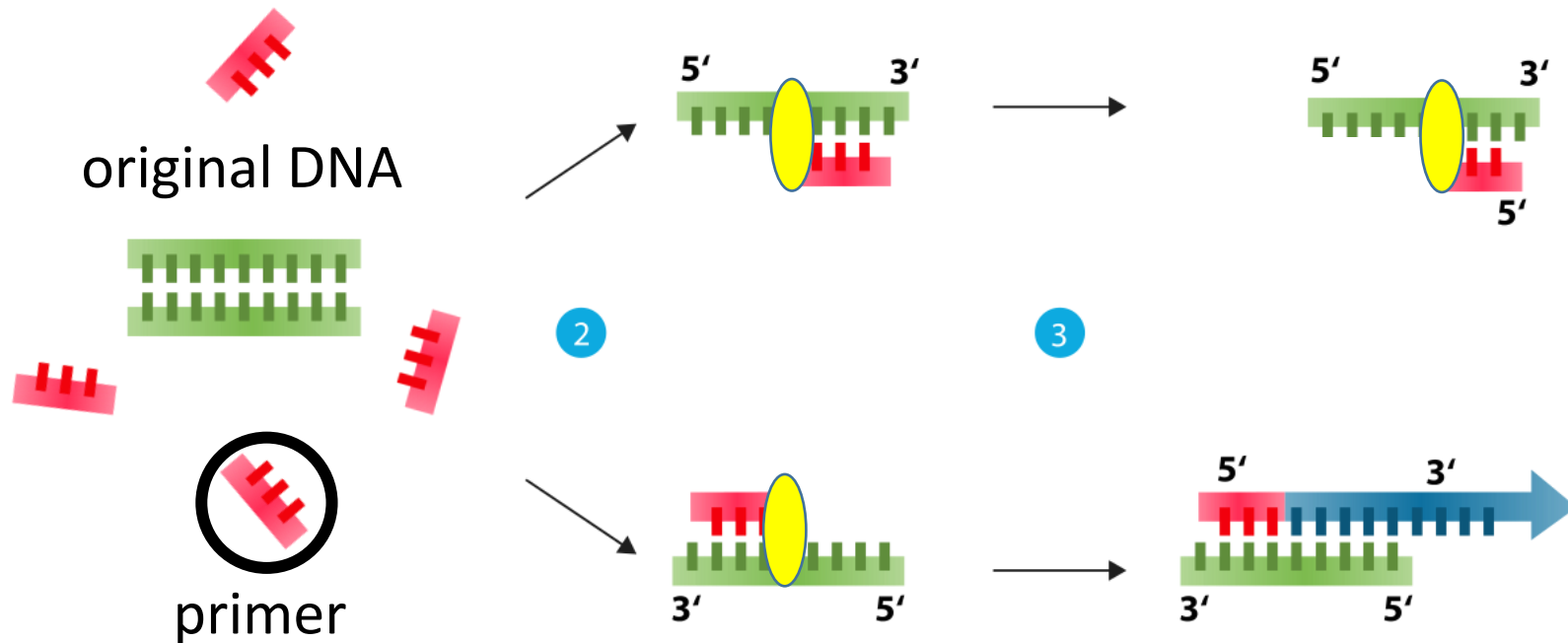
## *Polymerase Chain Reaction:*

A specific DNA sequence is amplified using primers & polymerase

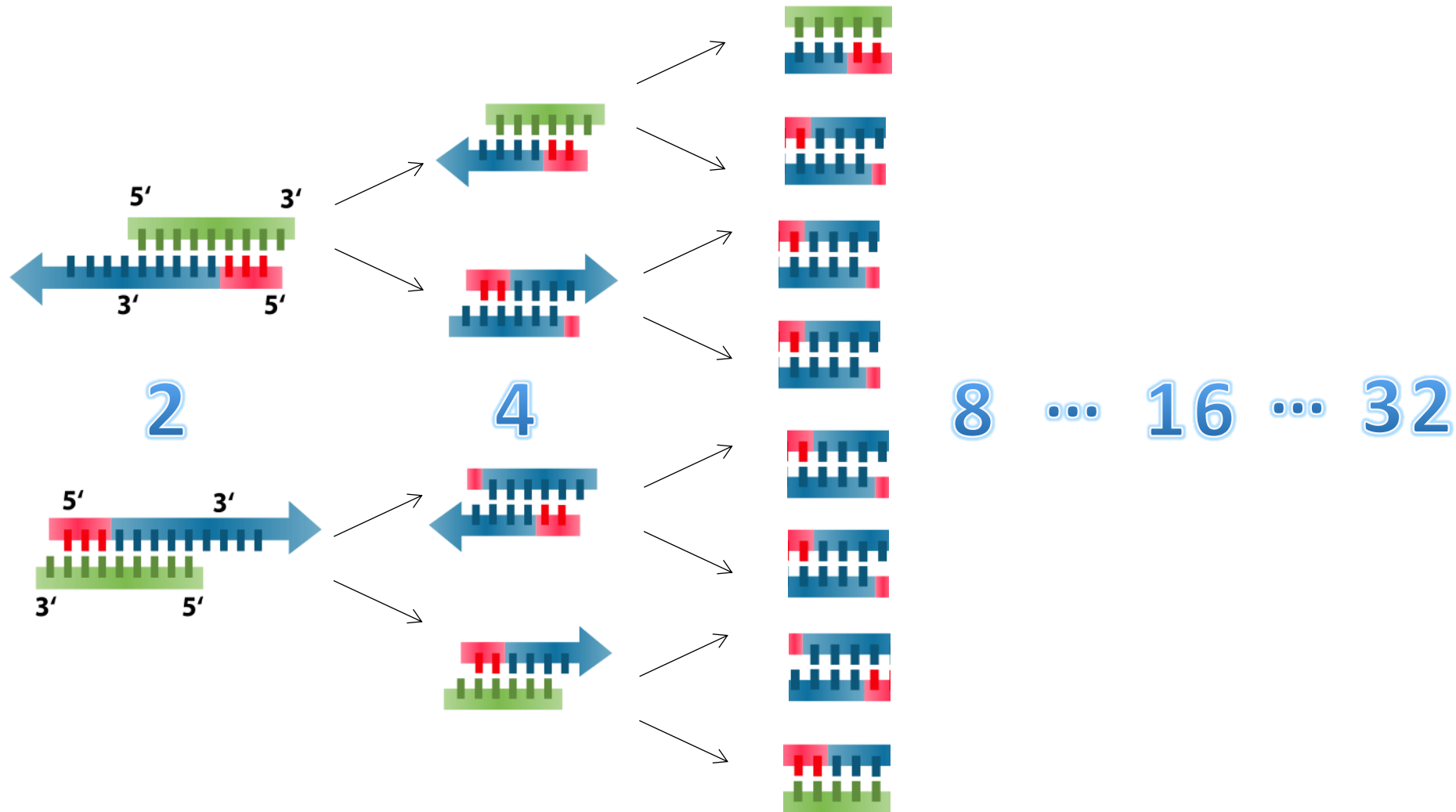


# Step 4: PCR - primers

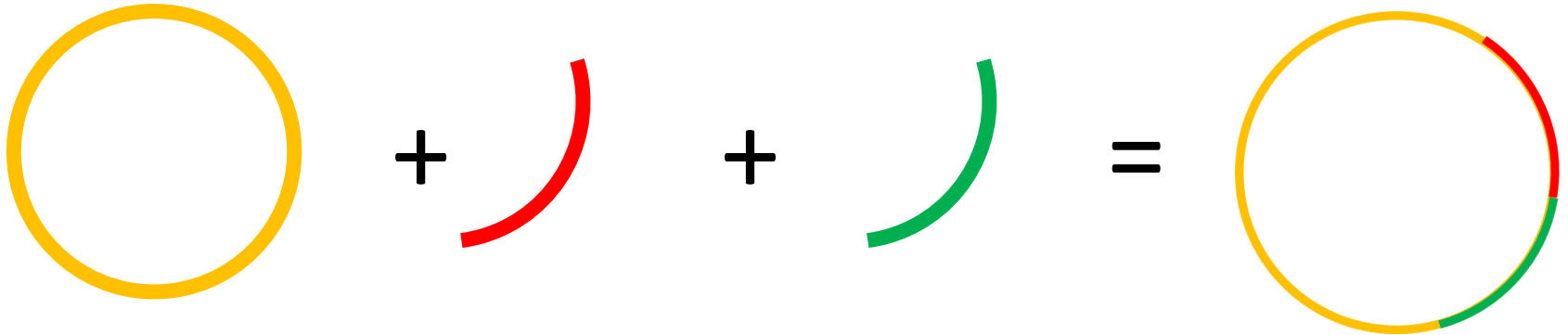
Polymerase



# Step 4: PCR - primers

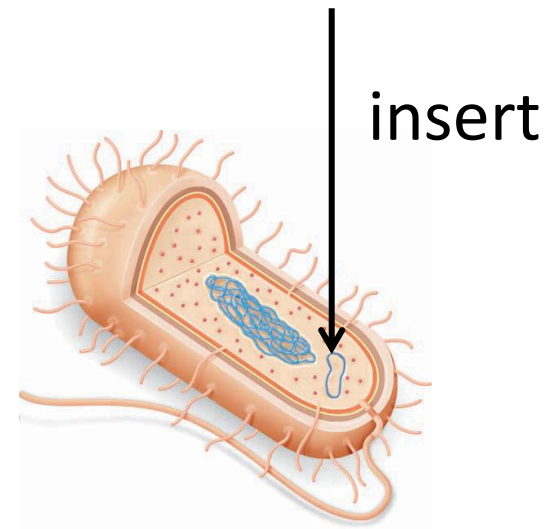


# Step 5: Put Into a Vector

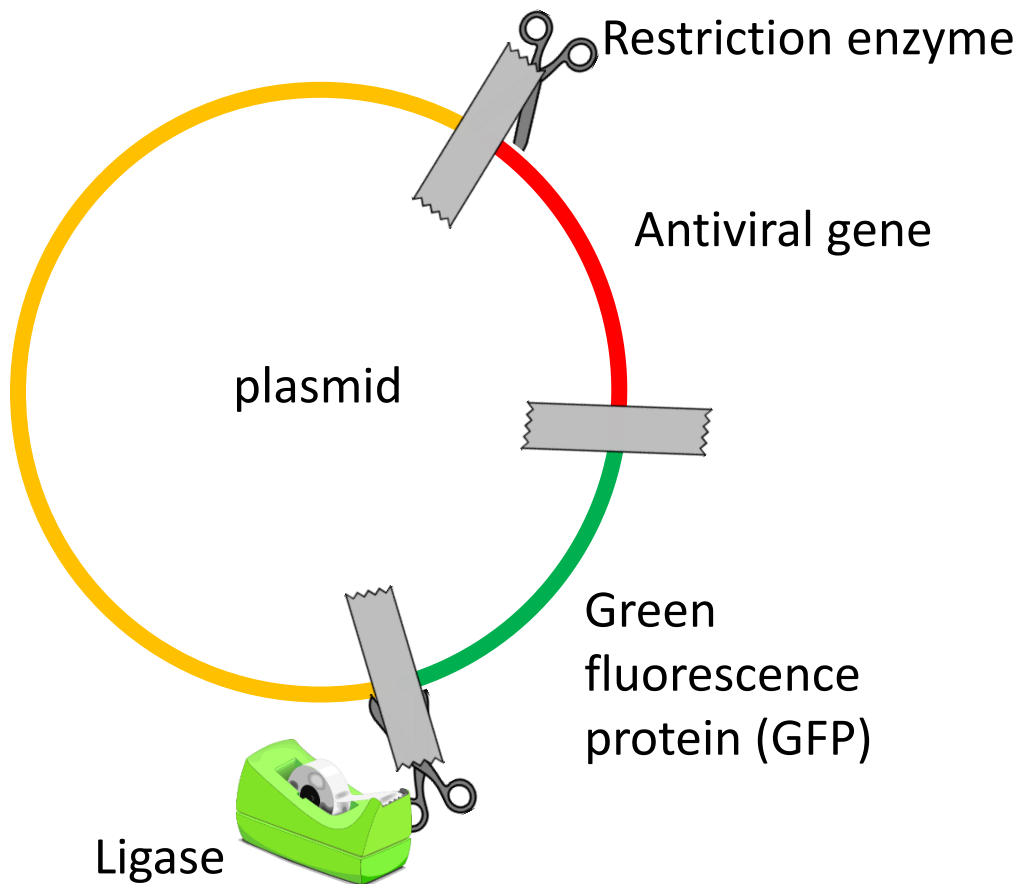


## Plasmid

- A vector/messenger that carries genes
- Can be placed in other organisms to express proteins



# Step 5: Put Into a Vector





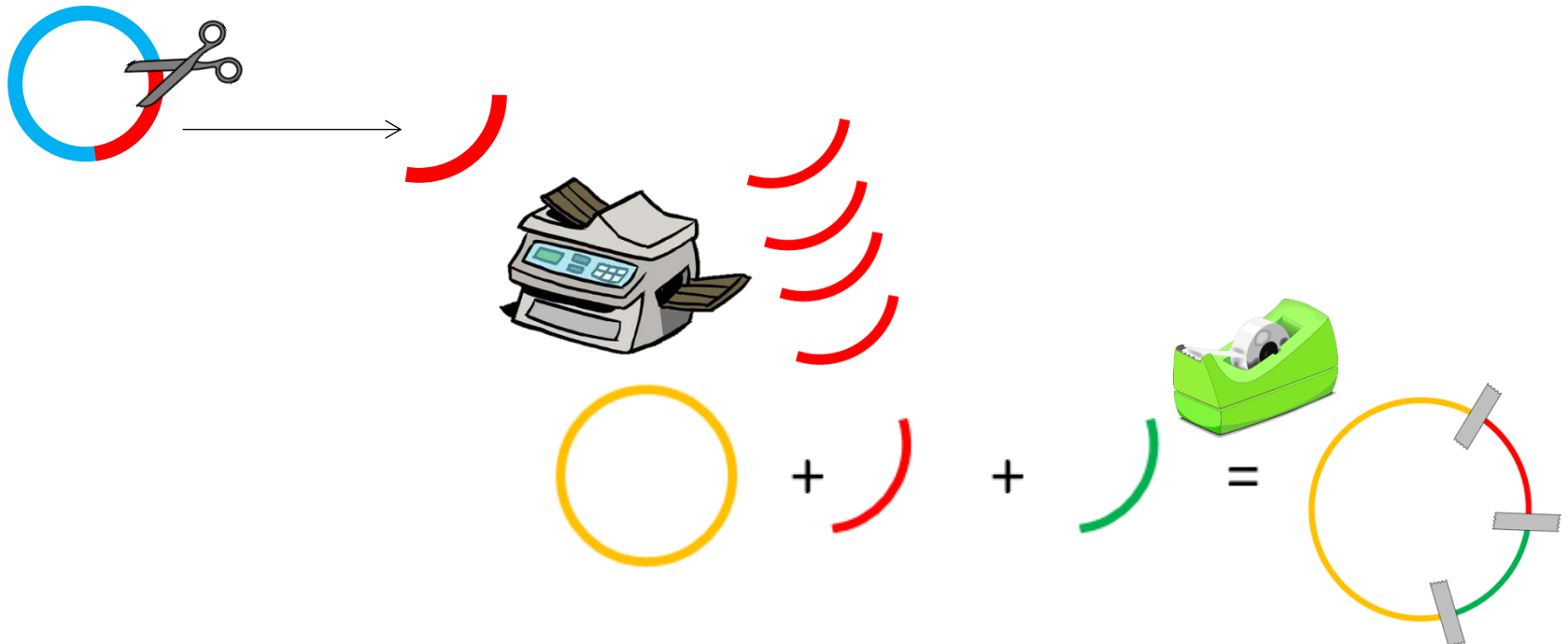
# Summary of workflow

Decide and  
order genes

Extract  
gene using  
RE

PCR to  
make more  
DNA copies

Fuse into a  
vector



# Controls

# Bonus slide

If you're seeing this, it means we've  
some extra time

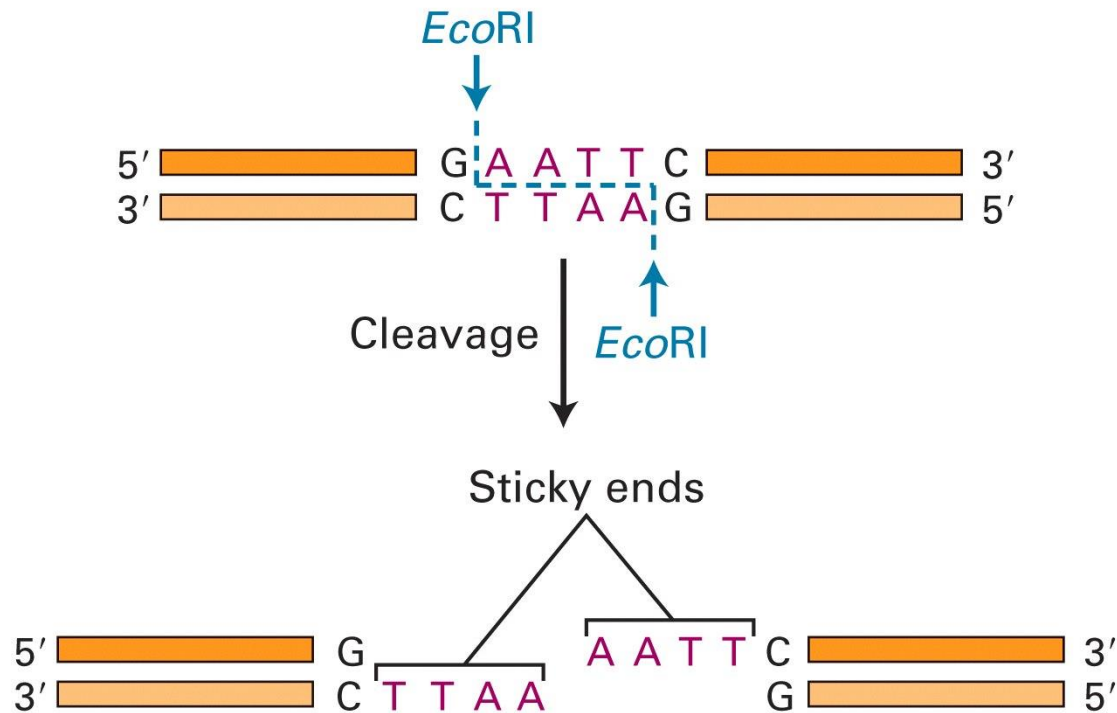
and

you don't have any questions about the  
earlier content (*esp PCR and Restriction  
Enzymes*).

Last chance to ask before we proceed...

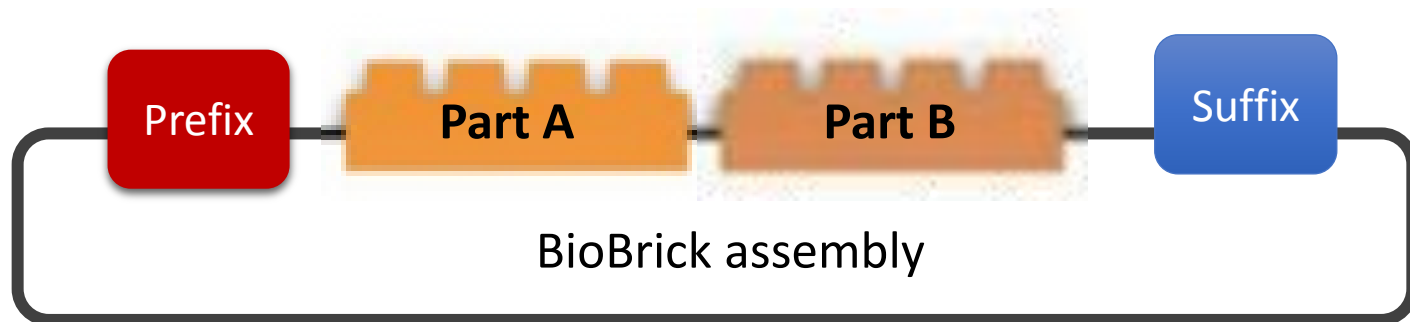
# Restriction Enzymes

- Enzymes that recognise a specific DNA sequence and cuts it.
- Eg



# BioBrick™

- Standardised biological ‘part’
  - A ‘part’ is anything that has a biological function.
- Catalogue/Repository of BioBrick parts available
- Metaphor of Lego bricks – can be assembled easily



# BioBrick assembly

- Metaphor of Lego bricks – can be assembled easily
  - Standardised prefix and suffix sequences
  - Doesn't this sound useful?

